Claims

[1]   An automated cross-connect system suitable for use in a telecom-
munication network in a central office including a network of com-
munication lines for connecting subscriber locations to a central office
exchange 112, said communication lines extend to the subscriber locations
from a main distribution frame (MDF) 320 that comprises a plurality of
termination means housed therein for terminating the communication lines
from to the subscriber locations and the lines from the exchange, such that
the automated cross-connect system is capable of establishing a plurality of
cross-connects for completing connections of the communication lines and
characterized in that,
the plurality of cross-connects are mounted on modular cross-connect
boards having switching means that are connected to the plurality of
termination means, and wherein automation of the MDF 320 is achieved
by selectively controlling the connection state of the plurality of cross-
connects remotely via the central office.

[2]   An automated cross-connect system according to claim 1 wherein the
remote computer terminal (350,352) communicates with a site controller
332 supervising the MDF to identify cross-connection boards and direct the
switching means for the appropriate cross-connects.

[3]   An automated cross-connect system according to claim 2 wherein the site
controller 332 is linked to the cross-connection boards via a com-
munication link that also provides power the switching means for operating
the cross-connects.

[4]   An automated cross-connect system according to any one of the above
claims wherein the modular cross-connect boards comprise a switch matrix
of sliding contact sledges that are moved into position by an electric motor.

[5]   An automated cross-connect system according to any one of the above
claims wherein the switch matrix comprises a plurality of electrically
conductive contacts are disposed on multiple PCBs by which any input line
can connectable to any output line is achieved by the moving the sledges
along different paths and transport planes.

[6]   An automated cross-connect system according to any one of claims 4 or 5
wherein the switch matrix further includes:
a bypass cross-connect for each line for bypassing the switch matrix if,
upon installation of the cross-connect board, there is a pre-existing cross-
connect made e.g. by jumper wire for the line, and

a reset position for each line for preserving an open line condition that is used when there is no jumper wire installed for the line upon installation of the cross-connect board or when the line is disconnected or removed.

[7]   An automated cross-connect system according to any one of the above claims wherein the cross-connect boards are mounted in a center stage interconnecting the line side and exchange side communication lines within the MDF cabinet.

[8]   An automated cross-connect system according to any one of the above claims wherein the remote computer terminal communicates with the site controller via the Internet, Ethernet, or LAN using TCP/IP based protocol, said remote computer terminal running network management application software (NMS) capable of selectively actuating all cross-connects within the system, verifying line connections, and running trouble shooting diagnostics.

[9]   An automated cross-connect system according to claim 8 wherein the NMS automatically checks, verifies, and establishes line connections in accordance with standard operator procedures.

[10]   An automated cross-connect system according to claim 1 wherein the cross-connection boards are installed in MDFs with pre-existing cross-connections established by jumper wires without disrupting the existing connections.

[11]   An automated cross-connect system according to any one of claims 1 wherein the plurality of cross-connect boards are further located in street cabinets 328 and drop point sites 330 that are in communication with the site controller in a manner such that the plurality of cross-connects are selectively controlled by the remote computer terminal.

[12]   An automated cross-connect system according to claim 11 wherein the site controller communicates with the street cabinets and drop point sites via modems coupled to a communication link, and wherein power for actuating the cross-connects is supplied over the link.

[13]   A method of automating cross-connects using an automated cross-connect system in a telecommunication network including a network of communication lines for connecting subscriber locations to a central office exchange 112, said communication lines extend to the subscriber locations from a main distribution frame (MDF) 320 that comprises a plurality of termination means housed therein for terminating the communication lines from to the subscriber locations and the lines from the exchange, the method is **characterized** in the steps of,

entering into a remote terminal 352 information related to making a desired
connection for activating, removing, or modifying a subscriber com-
munication line;

determining the appropriate central office MDF;

checking the current allocated resources relating to the MDF from a
database;

selecting an available communication line for connection to the exchange;
and

transmitting a command to the MDF comprising of a plurality of cross-
connect boards connected to said termination means wherein a specific
cross-connect board and cross-connect thereon is identified and selected to
automatically activate, remove, or modify the subscriber line.

[14]   A method according to claim 13 wherein in the determining step the in-
formation is sent to a system gateway 354 which determines whether the
subscriber communication line is accessible through the automated
telecommunication system.

[15]   A method according to claim 13 wherein the remote terminal is a computer
running network management application software (NMS) transmits
commands to a site controller 332 that supervises the MDF to identify and
select cross-connect boards and direct the switching means for operating
the cross-connects.

[16]   A method according to claim 15 wherein the site controller transmits
commands to the cross-connection boards via a communication link that
provides power to the cross-connect boards.

[17]   A method according to claim 13 wherein the cross-connection boards are
modular and comprise a switch matrix of sliding contact sledges that are
moved into position by electric motors.

[18]   A method according to claim 13 wherein the system is scalable to the
growth in subscriber lines within the MDF by installing additional cross-
connection boards.

[19]   A method according to claim 13 wherein the remote terminal com-
municates with the site controller via the Internet, Ethernet, or LAN using
TCP/IP based protocol.

[20]   A method according to any one of claims 15 or 16 wherein cross-connect
boards contained in street cabinets and drop point sites are automated for
control by the remote computer terminal via the site controller, in which
signals are transmitted and received via modems coupled to com-
munication link.

[21]   A method according to claim 13 wherein the NMS automatically tests,
            verifies, and documents current line connections in accordance with
            standard operator procedures.

[22]   A method according to claim 13 wherein the installation of the cross-
            connect boards into the termination means is non-intrusive and does not
            disrupt the existing connections.

[23]   A method according to claim 13 wherein in the transmitting step, a
            database is updated in accordance with the command for the associated the
            cross-connect.

[24]   A method according to claim 15 wherein when the route to the selected
            cross-connect is 'blocked' due to existing connections on the cross-connect
            board and stage levels such that the site controller determines an alternative
            route for reaching the cross-connect while maintaining the existing line
            connections.